2.7 Noise

2.7.1 Introduction

Noise is defined as unwanted sound. It is emitted from many sources including airplanes, factories, railroads, power generation plants, and highway vehicles. Highway noise, or traffic noise, is usually a composite of noises from engine exhaust and tire-roadway interaction.

The magnitude of noise is usually described by its sound pressure. Since the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, usually the decibel (dB). Sound pressures described in decibels are called sound pressure levels and are often defined in terms of frequency-weighted scales (A, B, C, or D).

The A-weighted decibel scale is used almost exclusively in vehicle noise measurements because it reflects the frequency range to which the human ear is most sensitive (1,000-6,000 Hertz). Sound levels measured using an A-weighted decibel scale are generally expressed as dBA. Throughout this report, all noise levels are expressed in dBAs. Several examples of noise pressure levels in dBA scale are listed in Table 2-8.

Table 2-8 indicates that most individuals in urbanized areas are exposed to fairly high noise levels. The degree of disturbance or annoyance of unwanted sound depends essentially on three things:

- The amount and nature of the intruding noise;
- The relationship between the background noise and the intruding noise; and
- The type of activity occurring where the noise is heard.

In considering the first of these factors, it is important to note that individuals have different sensitivity to noise. Loud noises bother some more than others and some patterns of noise also enter into people's judgment of whether or not a noise is offensive.

With regard to the second factor (i.e., the relationship between background noise and the intruding noise), individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). For instance, the blowing of a car horn at night when background noise levels are typically about 45 dBA would generally be more objectionable than the blowing of a car horn in the afternoon when background noises are likely to be 60 dBA or higher.

The third factor (i.e., the type of activity occurring where the noise is heard) is related to the interference of noises with activities of individuals. In a 60 dBA environment, normal work activities requiring high levels of concentration may be interrupted by loud noises, while activities requiring manual effort may not be interrupted to the same degree.

Attempts have been made to regulate many of these types of noises including airplane noise, factory noise, railroad noise, and highway traffic noise. In relation to highway traffic noise, methods of analysis and control which have been developed by the Federal Highway Administration (FHWA) and adapted by the Department are described below.

All receptors evaluated are categorized as FHWA Noise Abatement Criteria (NAC) Category B (residences, schools, churches, parks, etc.). As a result, outdoor noise levels that approach or

TABLE 2-8
A-WEIGHTED (DBA) SOUND LEVELS OF TYPICAL NOISE ENVIRONMENTS

A-Weighted	Overall Level	Noise Environment
120	Uncomfortably Loud (32 times as loud as 70 dBA)	Military jet takeoff at 15 meters (50 ft.)
100	Very Loud (8 times as loud as 70 dBA)	Jet flyover at 305 meters (1,000 ft.)
80	Loud (2 times as loud as 70 dBA)	Propeller plane flyover at 305 meters (1,000 ft.) Diesel truck traveling 65 kmph (40 mph) at 15 meters (50 ft.)
70	Moderately Loud	Freeway at 15 meters (50 ft.) from pavement edge Vacuum cleaner (indoor)
60	Relatively Quiet (½ as loud as 70 dBA)	Air conditioner unit at 31 meters (100 ft.) Dishwasher at 3.1 meters (10 ft.) (indoor)
50	Quiet (¼ as loud as 70 dBA)	Large transformers Small private office (indoor)
40	Very Quiet ($^1/_8$ as loud as 70 dBA)	Bird calls Lowest Limit of urban ambient sound
10	Extremely Quiet ($^1/_{64}$ as loud as 70 dBA)	Just audible
0	Threshold of Hearing	

Source: Federal Agency Review of Selected Airport Noise Analysis Issues, 1992.

exceed 67 dBA Leq(h) would require consideration of some form of noise abatement or mitigation measure. Leq(h) is the equivalent of a continuous sound level which, in a stated time period (1 hour) and at a stated location, has the same A-weighted sound energy as the time-varying sound.

However, the absolute NAC level of 67 dBA for Activity B land uses as provided by 23 CFR Part 772 is not the only determinant of noise mitigation. Consideration of noise abatement is also warranted when:

- Leq (h) noise levels approach the FHWA NAC given in Table 2-9, where "approach" means within 1 dBA of the NAC (i.e., at an absolute noise level of 66 dBA for Activity B land uses).

- There is a substantial increase in the predicted noise levels over the existing noise levels, regardless of whether or not the NAC level is exceeded.

Since the FHWA NAC does not specifically define "substantial noise increase," the substantial increase of 14 dBA as defined in the Department's noise policy was utilized in the analysis for this study. Therefore, any receptor(s) experiencing more than a 14 dBA increase over existing outdoor noise level, regardless of absolute noise level, was eligible for consideration of noise abatement. In addition, any Activity B land uses experiencing a post-project outdoor noise level of 66 dBA or greater was also eligible for consideration of noise abatement.

Further detailed information regarding noise methodology, data sources, model descriptions and noise sensitive receptors is provided in the Noise Technical Study which has been prepared separate from this DEIS.

2.7.2 FHWA and Department Policy

Traffic noise impact and abatement analyses were conducted in accordance with the procedures as set forth in the FHWA's *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, 23 Code of Federal Regulations (CFR) Part 772; reissued FHWA Policy and Guidance document dated June 1995; and the Department's *Procedures for Highway Project Noise Analyses*, April 3, 2000. The FHWA Noise Abatement Criteria (NAC) in 23 CFR Part 772, and the substantial noise level increase over existing noise level criteria (14 dBA) in the Department policy, were used to identify and evaluate any noise impact. The traffic noise level predictions and noise mitigation analyses were performed using FHWA's *Highway Traffic Noise Prediction Model* (Report No. FHWA-RD-77-108) and the *STAMINA 2.0/OPTIMA Noise Barrier Cost Reduction Procedure* (Report No. FHWA-DP-58-1). The FHWA NAC are presented in Table 2-9.

Since the FHWA NAC does not specifically define "substantial noise increase," the substantial increase of 14 dBA as defined in the Department's noise policy was utilized in the analysis for this study. Therefore, any receptor(s) experiencing more than a 14 dBA increase over existing outdoor noise level, regardless of absolute noise level, is eligible for consideration of noise abatement. In addition, any Activity B land uses experiencing a post-project outdoor noise level of 66 dBA or greater is also eligible for consideration of noise abatement.

2.7.3 Identification of Noise-Sensitive Areas

Generally, noise sensitive receptors correspond to existing or future planned noise sensitive developments (or groups of noise sensitive receptors as defined in 23 CFR Part 772), which are likely to be affected by changes in traffic volumes and design along U.S. Route 20 and the proposed interchanges and intersections.

TABLE 2-9
FHWA NOISE ABATEMENT CRITERIA (NAC)
Hourly A-weighted Sound Level in Decibels (dBA)

ACTIVITY CATEGORY	NOISE ABATEMENT CRITERIA	DESCRIPTION OF ACTIVITY CATEGORY
	L_{eq}	
A (Exterior)	57	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B (Exterior)	67	Picnic areas, recreation areas, playgrounds, active sports areas, and parks that are not included in Category A; and residences, motels, hotels, public meeting rooms, schools, churches, libraries and hospitals.
C (Exterior)	72	Developed lands, properties or activities not included in Categories A or B above.
D	—	Undeveloped Lands
E (Interior)	52	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

Source: Title 23, Code of Federal Regulations, Part 772.

In order to identify the areas where noise-sensitive land uses exist, a review of the topographic maps and aerial photographs of the project area was conducted in coordination with land use study results for this project. Noise sensitive receptors include schools, hospitals, churches, playgrounds and recreation areas, residential areas, Section 4(f) areas, etc. (i.e., Activity B land uses according to FHWA's NAC in 23 CFR, Part 772) in the project area. Noise sensitive receptors generally comprise clusters of these types of noise-sensitive land uses, and may sometimes include more than one of these uses. The locations of the noise sensitive receptors are delineated based on the locations of existing and proposed land uses, major interchanges and overpass bridges, and terrain features, as well as potential locations of the future noise abatement walls/berms.

2.7.4 Noise Monitoring Program

Based on review of aerial photos, engineering plans, and topographical maps, as well as site visits and input from the Department and from the general public, a total of 23 locations for

existing noise level monitoring were identified along existing and proposed U.S. Route 20. These monitoring locations were selected as representative locations along the Alternates. The noise monitoring locations within the project area are depicted on the Environmental Inventory Maps in Appendix N and in Volume 2 of the Noise Technical Study.

Existing A-weighted noise levels were monitored per FHWA's Measurement of Highway-Related Noise (FHWA-PD-98-0046) at each identified site by experienced technical staff, in order to establish the baseline noise environment. A set of Bruel & Kjaer 2236 and 2231 Precision Sound Level Meters (SLM) were used in field monitoring. These meters meet or exceed the requirements set forth in the ANSI S1.4-1983 Standards for Type 1 quality and accuracy. A total of 23 locations where measurements were collected represented existing noise levels for sensitive receptors along the proposed highway or expressway alignments. Acoustical calibrators (Bruel&Kjaer 4230 and 4231) were used to calibrate the SLMs for each measurement interval.

Ambient noise levels were measured at locations along the existing and proposed U.S. Route 20 corridor between October 26 and October 30, 1994. A total of 23 sites were measured during the weekday morning or evening peak hours. Four of the 23 sites were measured for a second time during the Saturday afternoon hours to determine the traffic noise levels during the weekend, while one site (Lena Nursing Home) was measured during the night-time hours for an 8-hour period to characterize the night time noise environment. The week day peak hours were determined to be between 7 a.m. and 9 a.m., and between 4 p.m. and 6 p.m. The weekend daytime hours were determined to be between 7 a.m. and 6 p.m.

In addition to the noise monitoring program, existing noise levels were also modeled at representative sensitive receptor locations along the existing U.S. Route 20 corridor using the existing year traffic. The existing noise levels presented in this analysis were based on both monitoring and modeling results.

2.7.5 Noise Modeling and Mitigation Analysis

FHWA's STAMINA 2.0/OPTIMA and TRAFFICNOISECAD software programs were utilized to determine the noise levels for existing year 2000 and future year 2020 No-Build and Build alternatives as well as to model and evaluate effectiveness of the noise abatement walls. STAMINA 2.0 is a FORTRAN program developed by FHWA to model the roadway traffic noise by inputting topographic information and traffic data. TRAFFICNOISECAD is a CAD-based processor program to convert the STAMINA 2.0 data files into graphic files for display, editing, and analysis.

As required by 23 CFR Part 772, noise mitigation measures that were considered included: (1) traffic management measures; (2) alterations of horizontal and vertical alignment; (3) acquisition of real property or interest therein to serve as a buffer zone; (4) acquisition of property rights for construction of noise barrier or earth berm; and (5) construction of noise abatement walls and/or berms. Those mitigation measures that were found to be appropriate were then analyzed in more detail. The most appropriate measure for this project was determined to be the construction of noise abatement walls, referred to as "noise barriers," and, in some areas, noise berms.

The reasonableness and feasibility of the noise barriers or berms were evaluated per FHWA and Department guidelines. The Department considers a barrier that results in a reduction of at least eight dBA at a receptor to be a substantial noise reduction, while a five dBA noise level reduction is also considered to be a benefit. Mitigation is designed to achieve these levels of noise reduction rather than a specified absolute noise level. Therefore, mitigation may be

appropriate even if the mitigated noise level exceeds FHWA's NAC for a particular activity category.

A cost-benefit analysis was also conducted to determine whether the construction of a noise barrier or berm is appropriate in each location. A factor of $24,000 per benefited receptor (i.e., 5 dBA or more noise level reduction) was used. In other words, if the per-unit cost of noise mitigation was $24,000 or less when considering receptors that received at least a 5 dBA reduction, then construction of a noise barrier was considered feasible and warranted.

2.7.6 Traffic Data Development

Traffic data developed by the Department for the existing year 2000 and future year 2020 No-Action Alternate and Alternates were reviewed and evaluated. These data included ADT, DHV, Level of Service (LOS), vehicle composition (i.e. truck and passenger car percentage), and design speeds. Since the traffic flow condition (volume, speed) is constrained by the physical conditions of the roadway, the worst-case noise level is also related to the traffic condition (volume, speed) on the roadway. Recent research indicates that the worst-case noise level generally corresponds to a LOS D condition. In the existing year 2000, peak-hour traffic on existing U.S. Route 20 experienced LOS D. In year 2020, the peak-hour traffic is anticipated to experience LOS E or F for the No-Action Alternate and LOS B for the various Alternates. The DHVs can be utilized as the peak hour volume, while the traffic speeds were modified based on peak hour LOS conditions, per Highway Capacity Manual (HCM) 1994, within the computer model to reflect an appropriate LOS condition, in order to represent a worst-case noise level scenario. For example, the average travel speed is 105 kmph (65.0 mph) for the Alternates, since the LOS condition during the peak traffic hour is Category B. The applicable speed for each LOS condition on a two-lane roadway is presented in Table 2-10.

TABLE 2-10
NOISE LEVEL LEQ VS. TRAFFIC CONDITION

LOS	Leq dBA	Maximum Volume veh/hr/ln	Average Speed km/hr (mi/hr)
A	71.1	650	105 (65.0)
B	73.1	1040	105 (65.0)
C	74.8	1548	104 (64.5)
D	75	1952	98 (61.0)
E	73.8	2300	90 (56.0)

Source: The Louis Berger Group, Inc., 2002.

2.7.7 Location of Noise Monitoring Sites

A total of 23 receptor locations were measured to provide existing noise levels, including eight receptors adjacent to existing U.S. Route 20, 11 receptors adjacent to the Freeway Alternates, and four receptors adjacent to the Expressway Alternates. These receptors are described in greater detail in Volumes 1 and 2 of the Noise Technical Report.

Receptors R1 through R8 are located along existing U.S. Route 20. Receptors R9 through R19 are located along the Freeway Alternates. Receptors R20 through R23 are located along the Expressway Alternates.

2.7.8 Description of Existing Monitored Noise Levels

In order to establish baseline data, existing daytime noise levels were measured at 23 locations selected as being representative of the variety of roadway-receptor configurations that exist in the project area. Land use categories for the 23 measured receptor sites, all of which fall into FHWA's Activity Category B, are distributed as follows: seven residential sites, one school, two nursing homes, two hotel/motels, and 11 farm houses. These 23 measured locations were distributed along the existing and proposed Freeway and Expressway Alternates in a manner that allowed existing and future noise levels to be estimated for each Alternate.

Table 2-11 provides the results of the noise monitoring along U.S. Route 20. The following information reflects the data presented in Table 2-11.

Area 1. U.S. Route 20 From lL84 North To East of Devil's Ladder Road near Galena Territory

- Noise levels were monitored at Site Nos. 1, 2, 3, 9 and 10. Sites 1,2 and 3 were located along existing U.S. Route 20 in this area. The monitored noise levels ranged from 64 to 68 dBA during the peak traffic hours, with the noise level at Site 2 exceeding the NAC of 67 dBA. The monitored noise levels ranged from 59 to 65 dBA during the weekend daytime hours. Sites 9 and 10 were located along the proposed alternates. The existing noise levels were measured ranging from 49 to 50 dBA. These levels did not approach or exceed the NAC of 67 dBA.

Area 2. U.S. Route 20 East of Devil's Ladder Road to Brown Road in Woodbine

Noise levels were monitored at Site Nos. 4, 11, 12, 13, 20, 21, 22 and 23. Site 4 was located along existing U.S. Route 20 in this area. The monitored noise level was 63 dBA during the peak traffic hour. Sites 11, 12, and 13 were located along the proposed alternates. The existing noise levels were measured ranging from 48 to 51 dBA. These levels did not approach or exceed the NAC of 67 dBA. Sites 20, 21, 22 and 23 were located along the proposed alternates. The existing noise levels were measured ranging from 39 to 43 dBA. These levels did not approach or exceed the NAC of 67 dBA.

Area 3. U.S. Route 20 Brown Road in Woodbine to County Line Road

- Noise levels were monitored at Site Nos. 5, 14 and 15. Site 5 was located along existing U.S. Route 20 in this area. The monitored noise level was 60 dBA during the peak traffic hour. The monitored noise level was 56 dBA during the weekend daytime hours. Sites 14 and 15 were located along the proposed alternates. The existing noise levels were measured ranging from 53 to 60 dBA. These levels did not approach or exceed the NAC of 67 dBA. The monitored noise levels was 56 dBA during the weekend daytime hours.

Area 4. U.S. Route 20 County Line Road to U.S. Route 20 Bypass west of Freeport

- Noise levels were monitored at Site Nos. 6, 7, 8, 16, 17, 18 and 19. Sites 6, 7 and 8 were located along existing U.S. Route 20 in this area. The monitored noise levels ranged from 60 to 66 dBA during the peak traffic hours. The peak-traffic noise level at Site 8 approached the NAC of 67 dBA. The monitored noise level was 57 dBA during the weekend daytime hours at Site 6. Sites 16, 17, 18 and 19 were located along the proposed alternates. The existing noise levels were measured ranging from 44 to 58 dBA. These levels did not approach or exceed the NAC of 67 dBA.

TABLE 2-11
MONITORED SOUND LEVELS

	Monitoring Receptor Location	Monitoring Location	Adjacent To	Time Period	Measured Sound Levels, L_{eq}, dBA	Approach or Exceeds NAC 67 dBA
Area 1	1	Galena Middle School	WB U.S. Route 20	AM	64	No
	2	Residence at the corner of U.S. Route 20 and Spring Street in Galena	WB U.S. Route 20	PM Weekend	68 65	Yes No
	3	Grant Hill Motel	WB U.S. Route 20	AM Weekend	65 59	No No
	9	Residence on Buckhill Road	Open Field	Midday	49	No
	10	Farm on Heller Road	Open Field	Midday	50	No
Area 2	4	Residence on U.S. Route 20 in Elizabeth	WB U.S. Route 20	PM	63	No
	11	Farm on Long Hollow Road	Open Field	Midday	51	No
	12	Farm on Long Hollow Road East of Snipe Hollow Road	Open Field	Midday	49	No
	13	Farm on Becker Road	Open Field	Midday	48	No
	20	Farm on Irish Hollow Road	Open Field	Midday	43	No
	21	Farm on Elizabeth-Hanover Road	Open Field	Midday	40	No

TABLE 2-11 (CONTINUED)
MONITORED SOUND LEVELS

	Monitoring Receptor Location	Monitoring Location	Adjacent To	Time Period	Measured Sound Levels, L_{eq}, dBA	Approach or Exceeds NAC 67 dBA
Area 2 (cont'd)	22	Elizabeth Nursing Home	Open Field	Midday	43	No
	23	Farm in Galena Oaks	Open Field	Midday	39	No
Area 3	14	Farm on Scout Camp Road	Open Field	Midday	53	No
	15	Farm on Stockton Road	Open Field	Midday	60	No
Area 4	6	KOA Kampground on U.S. Route 20	WB U.S. Route 20	AM Weekend	60 57	No
	7	Residence on U.S. Route 20 in Eleroy	WB U.S. Route 20	AM	64	No
	8	Copperfield Inn on U.S. Route 20	WB U.S. Route 20	AM	66	Yes
	16	Farm on Stees Road	Open Field	Midday	44	No
	17	Lena Nursing Home	Open Field	Midday	49	No
	18	Farm on Rink Road	Open Field	Midday	51	No
	19	Residence on N AYP Road	Open Field	Midday	58	No

Source: The Louis Berger Group, Inc., 2002.

2.7.9 Night-Time Noise Levels

Nighttime noise monitoring was conducted at Site No. 22 (Elizabeth Nursing Home) on February 17 and 18, 1998. Noise levels (30-minute Leq) during the 8-hour period (9:00 PM to 5:00 AM) ranged from 34 to 45 dBA. The noise levels did not approach or exceed the NAC of 67 dBA during the entire measurement period. The detailed noise levels (30-minute Leq) are presented in Table 2-12 below. Further detail regarding existing night-time monitored noise levels is provided in the Noise Technical Study.

TABLE 2-12
MONITORED SOUND LEVELS (Night-Time)

Start Time	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30
Leq	45	44	40	42	40	39	36	34	35	37	34	35	38	37	40	42

Source: The Louis Berger Group, Inc., 1998.

2.7.10 Description of Existing Modeled Noise Levels

Additional noise levels at the noise receptors adjacent to the existing U.S. Route 20 and other local roadways were modeled using FHWA STAMINA2.0 in conjunction with the noise monitoring results as described in this chapter (and in the Noise Technical Study), to further define the existing baseline noise levels. The results of the modeling are presented in Section 4.0 of this DEIS. The existing noise level modeling was based on the traffic information and topographic information from various maps, as previously discussed.

2.8 Natural Resources

2.8.1 Geology

The geologic setting of the project area includes Cambrian through Silurian bedrock on the flanks of a regional structural high (Wisconsin Arch) which are overlain with unconsolidated Quaternary deposits. The bedrock deposits are sedimentary rocks (sandstone, siltstone, shale, limestone, and dolomite); and surficial beds are unconsolidated. A generalized stratigraphic column of the surficial and subsurface units present in the project area is provided in Table 2-13.

2.8.1.1 Bedrock and Structural Geology

The top of the PreCambrian basement in the project area is at an elevation between 305 and 457 meters (1000 and 1500 feet) below mean sea level. In northern Stephenson County it is primarily a biotite granite and granitic gneiss. The Paleozoic bedrock stratigraphy of the project area consists of Silurian, Ordovician, and Cambrian age sedimentary units (Table 2-13). From oldest to youngest rocks, these units are: Mt. Simon Sandstone, Eau Claire Formation, Galesville Sandstone, Ironton Sandstone, Knox Group, Ancell Group (includes the St. Peter Sandstone), Ottawa Supergroup (includes the Platteville Group and Galena Group), Maquoketa Group, Hunton Supergroup.

TABLE 2-13
GENERAL STRATIGRAPHY OF PROJECT CORRIDOR

SYSTEM	SERIES	ROCK UNIT	HYDROSTRATIGRAPHIC UNIT Aquifer/Aquitard	DESCRIPTION
QUARTERNARY	Pleistocene	Multiple	Pleistocene	Unconsolidated glacial deposits—pebbly clay (till) silt and gravel. Loess (windblown silt), and alluvial silts, sands and gravels.
SILURIAN	Niagarian	Hunton Supergroup	Silurian dolomite aquifer	Dolomite, pure with local reef structures in upper 300 ft., prominent chert bands in middle, silty at base.
	Alexandrian			
ORDOVICIAN	Cincinnatian	Maquoketa Gp	Maquoketa confining unit	Shale, green, brown, silty
	Mohawkian	Ottawa Supergroup — Galena Gp / Platteville Gp	Galena-Platteville Unit	Dolomite and/or limestone, cherty. Dolomite and/or limestone, cherty, sandy at base.
	Chazyan	Ancell Gp — Glenwood Fm	Ancell Aquifer	Sandstone, fine and coarse grained; little dolomite; shale at top.
		Ancell Gp — St. Peter Ss		Sandstone, fine to medium grained; locally cherty red shale at base.
	Canadian	Knox Group	Prairie du Chien	Dolomite, sandy, charty (oolitic), sandstone. Sandstone, interbedded with dolomite. Dolomite, white to pink, coarse grained, cherty (oolitic), sandy at base.
CAMBRIAN	St. Croixan	Knox Group	Eminence-Potosi	Dolomite, white, fine grained, geodic quartz, sandy at base.
		Knox Group	Franconia	Dolomite, sandstone, and shale, glauconitic, green to red, micaceous.
		Ironton Ss	Ironton-Galesville aquifer	Sandstone, fine to medium grained, well sorted, upper part dolimitic.
		Galesville Ss		
		Eau Claire Fm	Eau Claire	Shale and siltstone; dolomite, glauconitic; sandstone, dolomitic, glauconitic
		Mt. Simon Ss	Elmhurst-Mt. Simon aquifer	Sandstone, coarse grained, white, red in lower half; lenses of shale and siltstone, red micaceous.
PRECAMBRIAN				Crystalline; no aquifers in Illinois.

Gp Group
Fm Formation
Ss Sandstone

Source: Larson et al., 1993.

These rocks are comprised of sandstones, shales, dolomites, and limestones. Lithologic descriptions of these units are provided in Table 2-13. Any units deposited between Silurian and Pleistocene time have been eroded and are not present in the project area. Throughout much of the project area Silurian rocks have also been eroded. They are confined to the tops of the higher hills and ridges (Figure 2-3).

The project area lies on the Wisconsin Arch, a regional structural high that extends southeast from central Wisconsin into Illinois. This arch borders the Illinois Basin, a structural depression covering six states, which lies to the south. There are no major fault systems in the project area.

2.8.1.2 Surface Geology and Topography

The bedrock sequence is directly overlain with Quaternary deposits related to Pleistocene glacial advances and retreats (glacial till, meltwater outwash, loess, ancient soil horizons) and post-glacial Holocene processes (alluvial and colluvial processes, modern soil formation, and human activities). There have been at least two Pleistocene glacial stages in Illinois: Illinoian and Wisconsinan (latest). The Wisconsinan glacial episode did not reach the project area. Illinoian glaciers, however, advanced from the east as far as Stockton. Thus, surficial units between Stockton and Freeport consist of tills deposited directly by Illinoian glaciers while tills are absent in the area from Stockton to Galena.

Although the Wisconsinan glaciers did not reach the project area, wind blown silt winnowed from the outwash of Wisconsinan meltwaters blanketed the entire project area. Other unconsolidated units include a meltwater deposit of Illinoian glaciers and alluvium in the floodplains and channels of modern rivers and streams. Figure 2-4 depicts the surface geology of the project area.

The entire project area lies within the Central Lowlands physiographic province of the United States. The proposed alignments traverse two physiographic divisions of the state of Illinois: the Driftless Section (Galena to Stockton) and the Rock River Hill Country Subsection of the Till Plains Section (Stockton to Freeport) (Figure 2-5).

The underlying geology influences the surficial topography of the project area. Since the driftless region was not covered by Pleistocene glaciers, thick glacial till deposits are absent. A plateau landscape of essentially flat and horizontal upland surfaces dissected with tributaries to the Mississippi River has developed. Uplands are underlain with a succession of sedimentary bedrock layers. Horseshoe Mound, located one mile east of Galena, has been designated an Illinois Natural Area (geological feature) as an outstanding example of a driftless area mound with exceptional dolomite outcrops. In contrast, the Rock River Hill Country region is underlain with glacial till and a landscape with very gently rolling hills has developed.

Topographic relief in the driftless region is about 180 meters (600 feet) with elevations ranging from under 180 meters (600 feet) above National Geodetic Vertical Datum (NGVD) 1929 at stream valley bottoms to over 335 meters (1,100 feet) NGVD on uplands. Topographic relief in the Rock River Hill Country is about 122 meters (400 feet) with elevations ranging from under 244 meters (800 feet) above NGVD at stream valley bottoms to over 335 meters (1,100 feet) NGVD on uplands.

There are 16 general soil mapping units called soil associations in the project area (Figures 2-6a and 2-6b). Soil associations have developed on surficial geologic deposits to form unique landscapes with complex relationships of soils, relief, drainage, and parent material. Six soil associations are within the project area in Jo Daviess County (Tama-Muscatine; Fayette-Palsgrove-Rozetta; Dubuque-Lacrescent-Dunbarton; Rozetta-Eleroy-Derinda; New Glarus-

Figure 2-3 Bedrock Geology

Figure 2-4 Surface Geology

Figure 2-5 Physiographic Divisions of Illinois

Figure 2-6a Soil Associations in Jo Daviess County

Figure 2-6b Soil Associations in Stephenson County

Lamoille-Lacrescent; Wakeland-Dorchester-Birds) and ten soil associations are within the project area in Stephenson County (Tama-Downs-Muscatine; Fayette-Rozetta; Flagg-Pecatonica; Woodbine-Dubuque; Camden-Woodbine; Dodgeville-Ashdale-Nasset; Dubuque-Dunbarton-Palsgrove; Eleroy-Derinda-Keltner; Plano-Batavia-Proctor; Lawson-Radford-Sawmill). These associations consist of two or three major soil series with minor soil series. Soil properties of the major and minor soil series of the soil associations that may be crossed by the project roadway place limitations on activities relevant to a roadway construction project. These roadway construction activities are: placement of highways or local roads; shallow excavations (1.5 or 2.0 meters [five or six feet]); and suitability for grassed waterways.

The seven most prevalent soil types (out of 57) underlying the Alternates in Jo Daviess and Stephenson Counties are mapped by the NRCS soil surveys as Downs silt loam**,** Dunbarton-Dubuque silty clay loam, Fayette silt loam, Lacrescent silt loam, Palsgrove silt loam, Rozetta silt loam, and Tama silt loam. These soils make up between 72 percent and 77 percent, depending on the alternate selected, of all the soils in the proposed right of way for U.S. Route 20. All soil discussions are taken from the above-mentioned soil surveys and are fully described in the Agricultural Resources Technical Report (ARTR).

Downs silt loam is developed in thick windblown deposits of fine-grained, calcareous silt or clay (loess) in intermediary prairie-forest areas. Downs soils, as they pertain to the project, are found predominately east of Stockton.

Dunbarton-Dubuque silty clay loam is a light-colored, well-drained soil that developed under forest vegetation on slopes that range from 7 percent to about 30 percent and where limestone occurs at less than 40 inches. Dunbarton-Dubuque soils, as they pertain to the project, are found predominately west of Woodbine.

Fayette silt loam consists of light-colored, well-drained soils that developed on thick loess-covered uplands under a mixture of deciduous forest vegetation. The largest areas in Stephenson County occur west of Freeport, extending to the county line. In Jo Daviess County, they extend from the intersection of Illinois Route 84 and U.S. Route 20 northwest of Galena to northwest of Woodbine. Fayette soils, as they pertain to the project, are found predominately west of Woodbine and east of Lena.

Lacrescent silt loam occurs on slopes with gradients that range from 15 percent to as much as 50 percent found primarily on steep valley slopes bordering the major drainage ways. Lacrescent soils, as they pertain to the project, are found predominately near Galena, Elizabeth, and Stockton.

Palsgrove silt loam is composed of light-colored, well-drained soils that developed under forest areas in the uplands on slopes that range from 2 to 25 percent. Palsgrove soils, as they pertain to the project, are found predominately near Galena and between Elizabeth and Stockton.

Rozetta silt loam is made up of light-colored, reasonably well-drained soils that developed entirely in loess under forest vegetation. Rozetta soils, as they pertain to the project, are found predominately near Woodbine and between Stockton and west of Lena.

Tama silt loam consists of dark-colored, well and reasonably well-drained soils that developed under prairie vegetation entirely in loess. Although Tama soils occur occasionally north and east of Freeport, they are most widespread in the prairie areas in western Stephenson County and across the southern portion of the county. Tama soils, as they pertain to the project, are found predominately near Elizabeth, Woodbine, Stockton, and Lena.

Highly erodible soils are defined as soil series phases with slope designations of C or higher (4 percent or steeper slopes). The highly erodible soils in the project area are listed in Table 2-14. The area of highly erodible soils within each alternate is presented in Table 2-15. Approximately 9,238 hectares (22,826 acres) of highly erodible lands occur within the project area. Areas of highly erodible lands are mainly confined to upland areas. These erodible lands are located within the steeply sloping portions of every soil association in the project area except the nearly level Wakeland-Dorchester-Birds association in Jo Daviess County and the nearly level Lawson-Radford-Sawmill association in Stephenson County.

2.8.1.3 Mineral Resources

Limestone and dolomite, and sand and gravel, are two mineral resources extracted in Jo Daviess and Stephenson Counties. Limestone and dolomite bedrock is quarried and crushed for use as aggregate in cement, as road-base stone for bituminous road surfaces, riprap, and agricultural lime. Sand and gravel are extracted from glacial deposits and used for the same construction purposes as those for limestone and dolomite.

There are 25 gravel pits and quarries identified on USGS topographic quadrangles of the project area. The May 1999 site visits found five of these to be active (Figure 2-7). In some cases, abandoned pits had been filled and there was no evidence of former activity.

One active facility is a dolomite quarry near U.S. Route 20 west of Elizabeth, the Galena Stone Products, Inc., Eustice Quarry. This quarry produces wall rock for decorative use and retention, septic stone for septic fields, crushed rock for gravel roads, chips as seal coat for oiled roads, agricultural stone finely crushed for fields, and aggregate for concrete in highways. The other active quarries are located in West Galena on North Ferry Landing Road; in East Galena on West Stagecoach Trail east of West Heller Lane; on North Mill Creek Road near Wenzel Mound about nine miles north of Elizabeth; and west of Stockton on East Center Road.

The project corridor traverses the heart of the zinc-lead district of northwestern Illinois, which is part of the Upper Mississippi Valley mining region of Illinois, Iowa, and Wisconsin (Figure 2-8). Zinc-lead ore deposits are found in the Galena and Platteville Groups. Zinc ore occurs as the mineral sphalerite (zinc sulphide) and lead ore as the mineral galena (lead sulphide). Ore deposits are present in vertical crevices at shallow depths or as deeper horizontal and inclined deposits (flat-and-pitch).

There are no known active zinc-lead mines in the project area. However, abandoned mines are present (see Exhibits, Sheets 3, 4, 5, 6, 7 and 8), particularly within the principal mineralized area surrounding Galena (Figure 2-7). Some of these mines have been sealed from access, generally by plugging and capping. The area between Buckhill Road and Council Hill Road, northeast of Galena, includes mines that date from the Native Americans and have historical interest. Mine locations are depicted on the exhibits.

2.8.1.4 Caves and Sinkholes

The prominence of carbonate rocks (limestone and dolomite) at or near the land surface makes the project area susceptible to the development of karst solution features. The driftless area is one of five regions in Illinois where karstic features are concentrated. Enlargement of existing fractures and the development of interconnected solution cavities by karstification make the carbonate bedrock of this area an important aquifer. However, because of the rapid recharge of karst aquifers, they are also very susceptible to contamination from surface sources.

TABLE 2-14
HIGHLY ERODIBLE SOILS

SOIL TYPE	PERCENT SLOPE	COUNTY
Dubuque silt loam	4 to 15 – 7 to 12	Jo Daviess – Stephenson
Tama silt loam	5 to 10 – 4 to 7	Jo Daviess – Stephenson
Elco silt loam	5 to 10	Jo Daviess
Rozetta silt loam	5 to 15	Jo Daviess
Fayette silt loam	5 to 45 – 4 to 30	Jo Daviess – Stephenson
Downs silt loam	5 to 15 – 4 to 12	Jo Daviess – Stephenson
Derinda silt loam	5 to 45 – 7 to 12	Jo Daviess – Stephenson
Schapville silt loam	5 to 15	Jo Daviess
Palsgrove silt loam	5 to 25 – 4 to 12	Jo Daviess – Stephenson
Eleroy silt loam	5 to 35 – 4 to 7	Jo Daviess – Stephenson
Nasset silt loam	5 to 15 – 7 to 12	Jo Daviess – Stephenson
Massbach silt loam	5 to 15 – 4 to 7	Jo Daviess – Stephenson
Miami silt loam	10 to 15	Jo Daviess
Dunbarton-Dubuque silt loams	7 to 25	Jo Daviess
New Glarus-Palsgrove silt loams	7 to 35	Jo Daviess
Dubuque-Orthents-Fayette complex	12 to 25	Jo Daviess
Lamoille silt loam	15 to 30	Jo Daviess
Seaton silt loam	25 to 45	Jo Daviess
Elizabeth silt loam	7 to 15	Jo Daviess
Chelsea loamy fine sand	20 to 45	Jo Daviess
Lacrescent silt loam	15 to 30	Jo Daviess
Lacrescent silty clay loam	30 to 50	Jo Daviess
New Glarus-Lamoille silt loams	15 to 35	Jo Daviess
Camden silt loam	4 to 18	Stephenson
Birkbeck silt loam	4 to 7	Stephenson
St. Charles silt loam	4 to 7	Stephenson
Harvard silt loam	4 to 7	Stephenson
Woodbine silt loam	4 to 12	Stephenson
Morley silt loam	4 to 18	Stephenson
Ashdale silt loam	7 to 12	Stephenson
Octagon silt loam	7 to 12	Stephenson
Schullsburg silt loam	7 to 12	Stephenson
Keller-Coatsburg complex	4 to 7	Stephenson
Fishhook-Atlas complex	4 to 12	Stephenson
Sogn silt loam	18 to 50	Stephenson
Dubuque and Dunbarton silty clay loams	7 to 12	Stephenson
Dubuque and Dunbarton silt loams	12 to 30	Stephenson

Source: The Louis Berger Group, Inc., 2002.

TABLE 2-15
U.S. ROUTE 20 HIGHLY ERODIBLE SOILS

SECTION		A-B	B-C	B-D	B-F	C-D	C-I	D-E	E-F (N)	E-F (S)	F-G	G-H (N)	G-H (S)	H-J	I-J	I-K	J-K	
ALIGNMENT ALTERNATE		GALENA BYPASS FREEWAY	EXPRESSWAY	IRISH HOLLOW FREEWAY	LONGHOLLOW FREEWAY	EXPRESSWAY-IRISH HOLLOW FREEWAY CONNECTOR	EXPRESSWAY	IRISH HOLLOW FREEWAY	IRISH HOLLOW TUNNEL FREEWAY	IRISH HOLLOW FREEWAY	FREEWAY	NORTH SIMMONS MOUND BYPASS FREEWAY	SOUTH SIMMONS MOND BYPASS FREEWAY	FREEWAY	EXPRESSWAY-FREEWAY CONNECTOR	EXPRESSWAY	FREEWAY	**TOTAL HIGHLY ERODIBLE SOIL (2) By Alternate**
1	LONGHOLLOW FREEWAY W/ NORTH SIMMONS MOUND BYPASS	240 (593)			306 (757)						44 (109)	57 (142)		57 (142)			66 (163)	771 (1,905)
2 (1)	LONGHOLLOW FREEWAY W/ SOUTH SIMMONS MOUND BYPASS	240 (593)			306 (757)						44 (109)		46 (113)	51 (126)			66 (163)	753 (1,860)
3	IRISH HOLLOW FREEWAY W/ NORTH SIMMONS MOUND BYPASS	240 (593)		183 (451)				54 (135)		122 (301)	44 (109)	57 (142)		51 (126)			66 (163)	817 (2,019)
4	IRISH HOLLOW FREEWAY W/ SOUTH SIMMONS MOUND BYPASS	240 (593)		183 (451)				54 (135)		122 (301)	44 (109)		46 (113)	51 (126)			66 (163)	806 (1,991)
5	IRISH HOLLOW TUNNEL FREEWAY W/ NORTH SIMMONS MOUND BYPASS	240 (593)		183 (451)				54 (135)	109 (269)		44 (109)	57 (142)		51 (126)			66 (163)	804 (1,987)
6	IRISH HOLLOW TUNNEL FREEWAY W/ SOUTH SIMMONS MOUND BYPASS	240 (593)		183 (451)				54 (135)	109 (269)		44 (109)		46 (113)	51 (126)			66 (163)	792 (1,958)
7	UPPER IRISH HOLLOW FREEWAY W/ NORTH SIMMONS MOUND	240 (593)	127 (315)			15 (37)		54 (135)		122 (301)	44 (109)	57 (142)		51 (126)			66 (163)	777 (1,920)
8	UPPER IRISH HOLLOW TUNNEL FREEWAY W/ NORTH SIMMONS MOUND	240 (593)	127 (315)			15 (37)		54 (135)	109 (269)		44 (109)	57 (142)		51 (126)			66 (163)	764 (1,888)
9	UPPER IRISH HOLLOW FREEWAY W/ SOUTH SIMMONS MOUND	240 (593)	127 (315)			15 (37)		54 (135)		122 (301)	44 (109)		51 (126)	51 (126)			66 (163)	771 (1,905)
10	UPPER IRISH HOLLOW TUNNEL FREEWAY W/ SOUTH SIMMONS MOUND	240 (593)	127 (315)			15 (37)		54 (135)	109 (269)		44 (109)		51 (126)	51 (126)			66 (163)	758 (1,873)
11	EXPRESSWAY SOUTH ELEROY	240 (593)	127 (315)				280 (693)									62 (153)		710 (1,754)
12	EXPRESSWAY NORTH ELEROY	240 (593)	127 (315)				280 (693)								1 (3)		66 (163)	715 (1,766)

1 Preferred Alternate
2 Highly Erodible Soil is defined as a soil type with a class of slope C or higher. The class of slope was taken from the Soil Survey of Jo Daviess County, Illinois (May 1996) and the Soil Survey: Stephenson County, Illinois (April 1976).
All quantities are hectares XXX or acres (XXX).

Figure 2-7 Abandoned Mines and Active Quarries in Jo Daviess County

Figure 2-8 Zinc-Lead District in Northwestern Illinois

Most sinkholes that have developed in the driftless area occur in Silurian dolomite while most caves occur in the Middle Ordovician Galena Group. Caves and sinkholes are known to occur within the project area. Sinkholes are associated with the Silurian dolomite at the Longhollow Observation Tower on U.S. Route 20 west of Elizabeth.

2.8.1.5 Land Subsidence and Landslides

Unique surface geological conditions that exist in the project area have led to the development of landslide prone areas. In the driftless area of Jo Daviess County, bedrock is at or near the ground surface. The shale is less resistant to erosion than the overlying dolomite. Preferential erosion of shale units removes support for overlying units. Rock creep (the continual movement of boulders at barely perceptible rates) also occurs. When wet, the top surface of the shale provides a slippery low angle surface on which overlying rocks move. The area surrounding U.S. Route 20 west of Elizabeth between the Apple River and the Longhollow Observation Tower has been mapped as an area of slumping and landsliding, predominantly as rock creep, where dolomite blocks are creeping downward on a shale slope. Slumping in the Maquoketa shale at an outcrop north of the tower has been documented. Geological conditions elsewhere in the project area, e.g., shallow bedrock overlain by loess and/or glacial till, and loess or glacial till overlying paleosols (ancient soil horizons), also create landslide prone conditions.

2.8.1.6 Groundwater Resources

The hydrostratigraphic units (aquifers and aquitards) in the project area are indicated in Table 2-13. Water-yielding aquifer units can be found in unconsolidated sand and gravel, sandstone, or dolomite and limestone. Sand and gravel aquifers are generally restricted to areas of moderately thick glacial deposits in the bedrock valleys associated with the Pecatonica River

near Freeport and Yellow Creek near Stockton. Important bedrock aquifers are Silurian dolomites perched atop the Maquoketa confining unit (shale); limestone and dolomite units in the upper Maquoketa Group; the Galena-Platteville unit; and the St. Peter Sandstone.

The Illinois Groundwater Protection Act of 1987 and the Illinois Wellhead Protection Program (approved by the USEPA on September 26, 1991) establish two management approaches for the protection of groundwater resources in Illinois: Wellhead Protection Areas (WHPAs) for public water supply wells and minimum setback zones for all public, private, and semi-private water supply wells Phase I WHPAs have been delineated as a fixed 305 meter (1,000 foot) radius for all water supply wells. Phase II WHPA delineations based on the 5-year time-related capture zone have been initiated for vulnerable systems (i.e., unconfined sand and gravel aquifers). All potable water supply wells have a minimum setback zone within a 61-meter (200-foot) radius. Community public water supply wells considered vulnerable due to geologic conditions have a radial 122-meter (400-foot) minimum setback zone. New potential sources and routes are prohibited within the minimum setback zone. Although there are potable water wells within 200 feet of the centerline of the alternates, this threshold is only relevant for routes or sources of groundwater pollution. Since the project will not introduce any new routes (dry wells or borrow pits) or sources (bulk road oil or deicing salt storage facilities), then there will be no violation of the wellhead setback requirements.

The Targeted Watershed Approach (TWA) described and applied by IEPA (1997) prioritizes watersheds on the basis of: 1) preventative criteria to ensure existing high quality water resources are protected, and; 2) restorative criteria to identify the most critical water resources in need of action to achieve water quality standards and attain full support of designated uses. The TWA process was used by IEPA to apply selection criteria to groundwater programs to

prioritize community public water supplies for protection. No areas have been designated as principal or sole-source aquifers in Illinois by the U.S. Environmental Protection Agency under Section 1424 (c) of the Safe Drinking Water Act.

The Illinois State Geological Survey (ISGS) identified over 170 private wells within 305 meters (1,000 feet) of the alternates. No public water wells were found within 305 meters (1,000 feet) of the alternates. The ISGS study was founded on their extensive database. However, there may be wells near the project alignment that are not included in any database. Most water in the area investigated by ISGS is obtained from limestone aquifers at depths ranging about 21 meters to 162 meters (70 to 530 feet) (ISGS, 2001). As of May 2001, there are no USEPA designated Sole Source Aquifers in or near the project area.

The following municipalities within the project area use groundwater wells to supply drinking water: Stockton, Freeport, Eleroy, Galena, Lena, Woodbine and Elizabeth. None of these municipalities use surface water resources to supply drinking water.

2.8.1.7 Groundwater Quality

A Preliminary Environmental Site Assessment (PESA) was conducted by ISGS along the alternates. This area was characterized as a high risk for the occurrence of hazardous materials based on the presence of potentially hazardous compounds at fourteen locations. At present, all sites may be sources of contamination to groundwater. In addition, farmland with applied pesticides and fertilizers are also potential sources of contamination to groundwater.

The vulnerability of shallow aquifers in the project area to surface sources of contamination (such as from disturbed contaminated soils and groundwater, and highway runoff) can be equated to contamination potential from surface and near surface waste disposal or related to aquifer recharge potential. Contamination and recharge potentials in the project area range from low to high due to variable geologic and soils conditions. Karst aquifers are particularly susceptible to contamination from surface sources.

2.9 Surface Water Resources and Water Quality

2.9.1 Surface Water Resources

Water resources in the project area consist of streams, lakes, ponds and wetlands. A total of 28 streams and their tributaries were assessed within the project area (Table 2-16). One lake, Lake Galena, occurs within the project area. This lake has been formed from the damming of Smallpox Creek and occurs upstream of all alternatives analyzed. No further discussion of this lake will be provided. Many small ponds are also present within the corridor. Non-maintained ponds support wetland vegetation around the periphery of the pond. Typical vegetation includes willows, cattails, reed canary grass, sedges, common reed, barnyard grass and smartweeds. Maintained ponds are actively used farm ponds, sewage lagoons, ornamental ponds, and active quarry and mining ponds. Both of these types of ponds are identified on the National Wetland Inventory maps as palustrine unconsolidated bottom wetlands. However, many are not considered jurisdictional wetlands. Wetlands are described in Section 2.11.

The project area crosses two major river basins of Illinois, the Upper Mississippi River Basin and the Rock River Basin (Figure 2-9). The streams in both of these basins drain to the Mississippi River. Water bodies within the project area are shown in Figure 2-10. The major streams and the size of their watersheds are depicted in Table 2-17. Land cover in these watersheds are dominated by agricultural (row crop, pasture, hayfield), forest and developed

Table 2-16 Description of Surface Water Resources

Figure 2-9 USGS Hydrologic Unit Map

Figure 2-10 Main Water Bodies

TABLE 2-17
NATIONAL WETLAND INVENTORY[1] CLASSES BY WATERSHED[2]

Watershed	Watershed Area Hectares (Acres)	PAB ha (ac)	PEM ha (ac)	PFO ha (ac)	PSS ha (ac)	PUB ha (ac)	PUS ha (ac)	R2UB ha (ac)	R4SB ha (ac)	R2US ha (ac)	Wetland Area ha (ac)
Galena River	15,120 (37,363)		15.6 (38.5)	60.3 (149.0)	9.9 (24.7)	8.7 (21.6)		95.0 (234.8)	2.8 (7.0)7		**192.5 (475.6)**
Smallpox Creek	8,333 (20,592)		9.3 (23.0)	20.8 (51.3)		5.8 (14.4)		13.1 (32.4)	2.1 (5.1)		**51.1 (126.2)**
Apple River	33,580 (82,979)	6.7 (16.5)	41.3 (102.1)	77.7 (192.0)	3.8 (9.5)	25.2 (62.3)		231.1 (571.0)	16.9 (41.8)	5.7 (14.2)	**408.5 (1,009.4)**
Mud Run	2,369 (5,854)		3.8 (9.3)	1.1 (2.7)	3.4 (8.3)	1.8 (4.5)		11.0 (27.2)	2.6 (6.4)		**23.6 (58.4)**
Rush Creek	19,278 (47,638)	0.3 (0.8)	74.1 (183.2)	115.3 (284.9)	3.6 (8.8)	40.0 (98.9)		59.8 (147.8)	1.8 (4.4)		**294.9 (728.8)**
Yellow Creek	50,354 (124,429)	4.4 (10.9)	114.8 (283.6)	163.8 (404.7)	12.3 (30.5)	27.7 (68.4)		234.2 (578.8)	31.3 (77.4)		**588.5 (1454.3)**
Pecatonica River	10,563 (26,102)	2.4 (6.1)	124.1 (306.6)	196.4 (485.4)	28.2 (69.6)	34.5 (85.2)	1.6 (3.9)	105.3 (260.3)			**492.5 (1217.1)**
Total	**139,600 (344,957)**	**13.9 (34.3)**	**382.9 (946.3)**	**635.4 (1570)**	**61.3 (151.4)**	**143.8 (355.3)**	**1.6 (3.9)**	**749.6 (1,852.3)**	**57.5 (142.1)**	**5.7 (14.2)**	**2,051.7 (5,069.8)**

[1] NWI Classification: P= Palustrine (wetlands), R= Riverine (streams), AB= Aquatic Bed, EM= Emergent, FO= Forested, SS= Scrub-shrub, UB= Unconsolidated Bottom, 2UB= Lower Perennial Unconsolidated Bottom, 4SB= Intermittent Streambed, 2US= Lower Perennial Unconsolidated Shore

[2] Watershed area: The area includes only those watersheds that occur in Jo Daviess and/or Stephenson Counties. The Apple River watershed includes only the main segment and does not include the upper tributaries (Mill Creek, West and South Forks of Apple River). Pecatonica River includes only the intermittent stream watersheds west of Freeport.

Source: Illinois Department of Transportation, 2002.

(urban and built-up) lands as shown in Table 2-4 and depicted on the Land Cover Maps (Appendix O). Specific streams that may be affected by the various alternatives are shown in Table 2-16.

The physical characteristics of the streams within the project area are summarized in Table 2-16 with regard to flow regime, substrate, depth and width, and the presence/absence of a woody riparian corridor. As determined from U.S. Geological Survey topographic maps most of the streams in the project area have permanent flow. Only Hughlett Branch, Waddams Creek and several tributaries of Yellow Creek have intermittent flow regimes. The streams in Jo Daviess County tend to have substrates of cobble, gravel and sand intermixed with silts. The streams in Stephenson County also contain cobble and gravel but have more silts, clays and muds. The largest streams in the project corridor are the Galena and Apple Rivers with widths up to 22.5 meters (73.8 feet). Smallpox and Yellow Creeks are the only moderate sized streams in the project area with widths up to 8.8 meters (28.7 feet). Most of the remaining streams have widths under 5.5 meters (18.0 feet). About half the streams in the project area have a woody riparian corridor. When the woody riparian corridor is present it is not very wide and does not extend for any great distances either upstream or downstream. Typical woody vegetation consists of Box elder, American elm, Green ash, Cottonwood and willows.

Two of the streams in the project area are listed as candidate streams because of their wild and scenic qualities. Approximately 83 kilometers (52 miles) of the Apple River and 133 kilometers (83 miles) of the Pecatonica River are listed on the Nationwide Rivers Inventory (NRI) compiled by the National Park Service. River segments on this list potentially qualify as national wild, scenic or recreational rivers. The NRI sections of the Apple River extend from its mouth to Hanover and from Hanover to the Wisconsin State line. These sections are listed due to the Outstandingly Remarkable Values (ORVs) of scenery, recreation and geology. The NRI describes it as a pleasant stretch of river flowing through hill and farm county with a scenic natural setting with smallmouth bass and trout fishing. The NRI sections of the Pecatonica River extend from its mouth northwest of Freeport to McConnel Road. These sections are listed on the NRI due to the ORVs of scenery and recreation. The river is described as a scenic stream flowing mainly through farm country with rolling hills.

2.9.2 Aquatic Resources

2.9.2.1 Fish

All sites sampled for fish in the project area are mainstem or tributary streams of three major drainages: the Apple, Galena, and Pecatonica River drainages. The IDNR collected fishery data within the project area during 1998 and 2000. In 1998, a total of 50 species and 3,965 individuals were collected in the Pecatonica Basin. Out of the 50 species, 8 had more than 150 individuals collected across all of the sampling sites. These included gizzard shad, hornyhead chub, central stoneroller, common shiner, spotfin shiner, bluntnose minnow, white sucker, and fantail darter. In 2000, a total of 50 species and 9,118 individuals were collected in the Mississippi North Basin. Out of the 50 species, 11 had more than 150 individuals collected across all of the sampling sites. These included creek chub, hornyhead chub, central stoneroller, largescale stoneroller, common shiner, bluntnose minnow, rosyface shiner, ozark minnow, white sucker, black redhorse, and fantail darter. Illinois Natural History Survey (INHS) personnel also collected fishery data in 1993, 1994, and 1995. See Table 2-16 for a listing of the predominant fish species found within the project area.

The Biological Stream characterization (BSC) is an Illinois stream classification system developed by the Illinois EPA/DNR BSC Work Group. The BSC is a multi-tiered stream quality classification based primarily on the attributes of lotic fish communities. The classification

ranges from A (Unique aquatic resource) to E (Restricted aquatic resource). Four streams in the project area have been rated. Furnace Creek, Yellow Creek and the Pecatonica River have a BSC rating of C (Moderate aquatic resource). The Apple River has a BSC rating of B (Highly valued aquatic resource) from Elizabeth north to the South Fork of the Apple River.

2.9.2.2 Mussels

A total of 41 individuals from five species of unionid mussels were observed in the project area. Six streams (Galena River, Smallpox Creek, Apple River, Rush Creek, and Yellow Creek) in the project area contained live mussels. Smallpox Creek, Yellow Creek and the Apple River contained the greatest number of individuals (13, 10 and 9, respectively). Apple Creek had the greatest number of species (3). The dominant species were Lilliput (17 individuals) and Giant floater (11 individuals). Both of these species are widespread and common in Illinois streams.

2.9.3 Surface Water Quality

The waterbodies of the project area are subject to the General Use water quality standards. These standards are established for the protection of aquatic life, wildlife, agricultural use, secondary contact use (e.g., boating) and most industrial uses and to ensure the aesthetic quality of the aquatic environment. Primary contact uses (e.g., swimming) are protected for all General Use waters where physical configuration permits such use. The streams of the project area must meet the General Use water quality standards specified in Title 35 of the Illinois Administrative Code Part 302 (35 Ill. Adm. Code 302) (1999). These standards shall apply at all times except during periods when flows are less than the average minimum seven day low flow which occurs once in ten years. The Designated Uses in the project area include overall, aquatic life, fish consumption and swimming uses.

Water quality sample results (1993 and 1994) are tabulated and compared to General Use standards in Table 2-18. Dissolved oxygen, pH, sulfate, chloride, total dissolved solids, and iron standards were met at each sample site. The phosphorus standard was met upstream of the points where it is applicable (i.e., where Smallpox Creek and its tributary enter Lake Galena). All sites met the ammonia standard when equations given in Section 302.212 of 35 Ill. Adm. Code 302 were applied to determine allowable ammonia nitrogen concentrations as a function of temperature and pH. Temperature and pH values measured at the time of sampling were used for these calculations. During the 1993 sampling period, the chronic standard for total mercury was slightly exceeded in Furnace Creek (August), Apple River (September), Wolf Creek (September), Tributary D of Yellow Creek (September) and Unnamed Tributary of the Pecatonica River (September). Later samples taken at these locations in 1994 did not exceed the standards. The reason for the slightly elevated mercury readings at these five sites is not known.

IEPA assesses surface water quality in terms of the degree to which designated uses are attained. Full support means that water quality meets the needs of all designated uses protected by applicable water quality standards. Partial support/minor impairment means water quality has been impaired, but only to a minor degree. There may be minor exceedences in applicable water quality standards or criteria. Partial support/moderate impairment means water quality is impaired to a greater degree, inhibiting the waterbody from meeting all the needs for that designated use. Nonsupport means that the waterbody does not attain the designated use to any degree. Generally, streams rated as Full are considered to have “good” resource quality. Streams rated as Partial are considered “fair”, and a rating of Nonsupport represents “poor” resource quality. Use-Support Assessments from the Illinois Water Quality Report 2002 for streams in the project area are given in Table 2-16.

TABLE 2-18
COMPARISON OF AVERAGE WATER QUALITY RESULTS TO GENERAL USE WATER QUALITY STANDARDS

(Based on data collected by the Illinois Natural History Survey from August 1993 to June 1995)

PARAMETERS *		WATER BODY																		
		1	3	4	6	7	8	10	11	12	13	14	15	17	18	19	1A	2A	3A	4A
	Standard**																			
Water Temperature (ºC)		10.67	N/A	11.83	11.67	10.33	7.50	18.00	7.50	12.33	11.50	11.67	10.33	12.00	11.00	12.00	28.00	28.00	22.00	19.50
Ammonia Nitrogen [0.005]	never >1.5; site-specific limit is a function of pH and temp	0.07	0.07	0.15	0.07	0.10	0.11	0.08	0.09	0.08	0.07	0.11	0.10	0.07	0.05	0.23	0.04	0.03	0.03	0.05
Total Phosphorus [0.01]	0.05 ***	0.05	<0.01	<0.04	<0.05	<0.03	<0.09	N/A	0.05	<0.05	<0.06	<0.14	0.21	0.07	<0.09	0.23	0.05	0.03	<DL	<DL
Dissolved Oxygen	never < 5.0	11.10	N/A	11.67	11.77	11.13	11.75	9.60	12.05	12.90	11.53	10.50	10.70	12.27	7.77	11.20	10.60	9.60	9.10	10.60
Hydrogen Ion Concentration (pH)	6.5 to 9.0	8.20	8.11	8.10	8.24	8.11	8.14	8.10	8.09	8.15	8.00	7.99	7.85	8.15	8.10	8.10	8.58	8.45	8.41	8.32
Alkalinity, as $CaCO_3$	N/A	311.00	309.00	284.25	303.00	324.00	309.67	325.00	306.33	309.25	323.75	326.50	291.75	273.75	276.25	334.00	300.00	271.00	317.00	316.00
Specific Conductivity (mmhos/cm)	N/A	798.67	N/A	535.33	593.67	637.00	663.50	660.00	608.00	688.67	680.33	788.00	753.00	674.67	682.00	790.00	657.00	657.00	740.00	745.00
Sulfur as Sulfate [0.01]	500	153.71	65.30	27.53	27.54	26.50	30.27	30.68	31.62	37.42	26.01	41.62	34.02	29.55	24.67	35.85	54.90	31.10	34.40	24.70
Chlorides [0.1]	500	16.28	6.30	12.42	7.28	10.37	14.79	7.94	7.12	15.74	16.90	42.33	42.55	30.69	22.76	41.56	16.30	9.93	5.21	7.14
Total Dissolved Solids [4]	1000	645.33	428.00	365.33	362.67	404.00	432.00	408.00	376.00	408.00	434.67	522.67	484.00	456.00	416.00	512.00	428.00	404.00	448.00	428.00
Dissolved Barium [0.005]	N/A	0.08	0.07	0.08	0.16	0.09	0.07	0.14	0.12	0.08	0.10	0.11	0.11	0.11	0.08	0.09	0.08	0.09	0.11	0.09
Dissolved Cadmium [0.01]	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.01
Dissolved Copper [0.01]	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	N/A	<0.01	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.01
Dissolved Iron [0.01]	1.0	0.10	0.03	0.05	0.06	0.07	0.05	0.05	0.05	0.06	0.09	0.05	0.14	0.06	0.02	0.08	0.01	0.01	0.01	0.01
Dissolved Manganese [0.01]	N/A	0.06	0.06	0.05	<.1	0.05	0.06	N/A	0.03	0.01	0.06	0.02	0.09	0.06	0.03	0.07	0.02	0.01	0.02	0.02
Dissolved Nickel [0.03]	N/A	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Dissolved Lead [0.08]	N/A	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Dissolved Zinc [0.01]	N/A	0.17	0.02	<0.01	<0.02	<0.03	<0.02	<.01	<0.04	<0.03	<0.03	<0.45	0.05	<0.19	<0.01	<0.01	0.10	0.19	0.19	0.21
Total Mercury [0.00005]	0.00005	<0.00005	<0.00005	<DL	<0.00005	0.000237	0.000091	<DL	<0.00005	0.000069	<DL	<DL	0.0014	<0.00005	<DL	0.00013	<DL	<DL	<DL	<DL

Footnotes:
* Unless otherwise specified, all measurements are expressed in milligrams per liter (mg/l)
** Surface water quality standards are taken from: Illinois Environmental Protection Agency. 1999. Title 35: Environmental Protection.Subtitle C: Water Pollution. Chapter I. Pollution Control Board. Part 302 - Water Quality Standards. Sections 302.201 through 302.212
*** Total phosphorus shall not exceed 0.05 mg/l in any stream at the point where it enters any reservoir or lake with a surface area of 20 acres. This standard is applicable only to Smallpox Creek (2A) and its tributary (3A) where they enter Lake Galena.

Legend:
[ ] - Detection Limit (DL)
N/A - Not Available

Sampling Sites:

Site Number		Site Number		Site Number		Site Number	
1	Galena River	8	Apple River	15	Yellow Creek Tributary D	3A	Unnamed tributary Smallpox Creek
3	Hughlett Branch	10	Irish Hollow Creek	17	Yellow Creek	4A	Snipe Hollow Creek
4	Smallpox Creek	11	A second site along Irish Hollow Creek	18	Yellow Creek Tributary C		
6	Long Hollow Creek	12	Wolf Creek	19	Unnamed Tributary to the Pecatonica		
7	Furnace Creek	13	Rush Creek	1A	East Branch Galena River		
		14	Rindesbacher Creek	2A	Smallpox Creek		

When a stream is found to be in Partial or Nonsupport for any designated use, the stream and that specified designated use are called 'impaired'. For impaired streams, Illinois EPA then identifies potential "causes" and "sources" of impairments of those designated uses. Four streams in the project area have impaired uses (Table 2-16). The Galena River in the vicinity of Galena is assessed as being in Partial Support of its Overall, Aquatic life and Fish consumption Uses. It is in Nonsupport of its Swimming Use. The potential causes of impairment are from PCB's, pH, habitat alteration, pathogens and suspended solids. The potential sources of these impairments are from agriculture (grazing related sources), urban runoff/storm sewers, channelization and other unknown sources. The Apple River is in Nonsupport of its Swimming Use. The potential cause of this impairment is pathogens from unknown sources. Yellow Creek is assessed as being in Partial Support of its Overall and Aquatic life Uses. The potential cause of this impairment is from nitrates. The potential source of the impairment is from agriculture (non-irrigated crop production and pastureland). The Pecatonica River is assessed as being in Partial Support of its Fish consumption and Swimming Uses. The potential cause of this impairment is PCBs from unknown source(s).

Waters that are identified as impaired are identified on a list, referred to as the Section 303(d) list. Waters identified on this list are subject to the development of Total Maximum Daily Loads (TMDL). A TMDL is the sum of the allowable amount of a single pollutant that a water body can receive from all contributing sources and still meet water quality standards or designated uses.

Currently, all four streams (Galena River, Apple River, Yellow Creek and the Pecatonica River) are listed on the draft Illinois EPA Section 303(d) list of impaired streams. None of these streams are scheduled for TMDL preparation at this time.

In summary, those surface waterways that have been assessed by the Illinois EPA are considered to have good or fair resource quality. Only the swimming use was considered poor for the streams having that designation. The Apple River is considered the highest quality stream in the project area based on its BSC rating of B (highly valued aquatic resource) and its listing as a candidate stream for consideration as a Wild and Scenic River.

2.10 Floodplains

Floodplain encroachment onto the 100-year floodplain is regulated and managed by federal, state, and local governments through federal Executive Order 11988, the National Flood Insurance Program, Illinois' Governor Executive Order 4, state permits authorized by the Rivers, Lakes and Streams Act (615 ILCS 5, 1994), and county and municipal ordinances. Table 2-19 lists the streams with 100-year floodplains, designated on Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) and Flood Boundary and Floodway Maps, within the project area (see Appendix K for floodplain maps). No regulatory floodways are located within the project area.

The natural and beneficial floodplain values in the project area include water resources, fish and wildlife resources and agricultural resources. The cover types occurring in the floodplains at each proposed crossing consist mostly of agricultural resources (pasture and row crops), as identified in Table 2-19 and depicted in the Exhibits.

2.11 Wetlands

The federal government endorses using two separate wetland delineation manuals for the purposes of complying with the Section 404 program, namely, the 1987 USACE's Wetlands Delineation Manual and the National Food Security Act Manual-Third Edition. A 1994 federal

TABLE 2-19
DESIGNATED 100-YEAR FLOODPLAINS
WITHIN THE PROJECT AREA

Alternate Section	Stream	Sheet No.	Approximate Average Width of 100-Year Floodplain		Cover Type(s)*
			Meters	Feet	
A-B	Galena River	5	293	960	2, 4, 22
A-B	Small Pox Creek	9, 10	168	550	13
B-D	Apple River	23, 24	472	1,550	4, 22
B-F	Furnace Creek	28, 29	180	590	2, 3
B-F	Furnace Creek	30	375	1,230	2, 3, 5
B-F	Apple River	32	244	800	4, 22
C-D	Apple River	38	530	1,740	2, 3, 4, 22
C-I	Apple River	39	143	470	4, 22
C-I	Wolf Creek	40	884	2,900	2, 4
C-I	Wolf Creek	41	363	1,190	2, 4
C-I	Yellow Creek Tributary A	53	79	260	4, 8
C-I	Yellow Creek	54, 55	232	760	2, 4, 5
C-I	Yellow Creek Tributary B	55	43	140	2, 4
C-I	Yellow Creek Tributary B	55, 56	177	580	2, 4
D-E	Wolf Creek	61	344	1,130	2, 4
H-J	Yellow Creek Tributary A	93	155	510	4, 13
H-J	Yellow Creek	94	427	1,400	2, 4
H-J	Yellow Creek Tributary D	94	34	110	4
H-J	Yellow Creek Tributary D	94	55	180	4
H-J	Yellow Creek Tributary D	94	49	160	4
I-K	Unnamed Tributary to Pecatonica River	108	64	210	4, 5
J-K	Unnamed Tributary to Pecatonica River	114	244	800	2, 4, 5

**** Code***

2	Pasture
3	Hayfield
4	Agricultural Land
5	Developed Land
8	Non-native Grassland
13	Floodplain Forest
22	River

Note: Sheet Nos. refer to sheets contained in Exhibits.
Source: The Louis Berger Group, Inc. 2002.

Memorandum of Agreement (MOA), involving the U.S. Departments of Agriculture, Defense, Interior, and USEPA, defines the situation in which these two manuals are to be applied. The MOA requires all federal resource agencies to use the 1987 USACOE Manual (with current USACE guidance) on non-agricultural land for Section 404 purposes. The National Food Security Act Manual-Third Edition is required when determinations and/or delineations are made on agricultural lands for Section 404 purposes.

Wetlands within Jo Daviess and Stephenson Counties were inventoried in 1994 as part of the Illinois Critical Trends Assessment Project (IDNR, 1996) and are summarized in Table 2-20. Approximately 4-9 percent of Jo Daviess and Stephenson Counties contained pre-settlement (1820) wetlands. In Jo Daviess County, wetlands now occupy approximately 2.2 percent of the county. For Stephenson County, wetlands now occupy approximately 1.4 percent of the county. From a statewide perspective, approximately 3.2 percent of total surface area is covered by wetland. The most prevalent type statewide and in Jo Daviess and Stephenson Counties is bottomland forest. In Jo Daviess County most of the bottomland forest occurs along the Mississippi River. In Stephenson County most of the bottomland forests are along the Pecatonica River. Both of these river systems lie outside the project area.

TABLE 2-20
WETLAND RESOURCES
WITHIN JO DAVIESS AND STEPHENSON COUNTIES

Wetland Type	Jo Daviess		Stephenson	
	Total Hectares	Percent of County	Total Hectares	Percent of County
Shallow Marsh/Wet Meadow	198	0.1	662	0.5
Deep Marsh	47	<0.1	47	<0.1
Bottomland Forest	3,038	1.9	1,247	0.9
Shallow Water	162	0.1	120	<0.1
Total	3,445	2.2	2,076	1.4

Source: IDNR, 1996; The Louis Berger Group, Inc., 2002.

Wetlands within the project area were identified during field surveys conducted in 1994 and 1999. All potential wetlands in the project area were examined and 238 routine onsite wetland determinations were performed in the project area. A total of 203 individual sites or complexes were identified as jurisdictional wetlands. Approximately 91.6 hectares (226.31 acres) of jurisdictional wetlands occur in the project area.

Wetland functions were assessed qualitatively for each site during the field delineations. Field assessments were based on visual observations, including plant community composition and structure, landscape position, surrounding land uses, hydrologic inputs and discharges, and soils. Specific functions included species composition (Floristic Quality Index, Percent Adventive), size, hydrology and wildlife habitat.

The Floristic Quality Assessment (FQA) methodology developed by Swink and Wilhelm (1979) and modified by Swink and Wilhelm (1994) and Taft et al (1993) and Taft (1995) was applied to the wetland plant communities in the project area. The resultant numerical rating is termed the Floristic Quality Index (FQI). The FQI provides a measure of the floristic integrity or level of

disturbance of a site. An FQI score below 10 suggests a site of low natural quality; while a score below 5 may denote a highly disturbed site. An FQI value above 20 suggests that a site has evidence of native character and may be considered an environmental asset. The implementing rules to the Illinois Interagency Wetland Policy Act require a 5.5 to 1.0 mitigation ratio for impacts to wetland sites having a FQI of 20 or higher. Of the 203 wetlands in the project area, thirty-eight have FQIs below 5, sixty-six have FQIs between 5 and 10, fifty-five between 10 and 15, twenty-four between 15 and 20 and twenty have FQIs over 20. The highest FQI was 35.1 and the lowest was 0.4. Specific FQI scores for each delineated wetland site in the project area may be found in the Ecological Resources Technical Report. FQI scores for wetlands proximate to the proposed alternates are presented in Table 2-21.

Another indicator used for measuring site quality is the measurement of percent adventive. This indicator compares the percentage of non-native invasive flora to native flora. It is derived by dividing the number of invasive plant species found within a plant community by the total number of plant species found on the site and then multiplying the result by 100 to derive a final percentage. Higher percentages of invasive plant species generally indicate that the plant community has been disturbed in the past. Within the project area (Table 2-21) the average Percent Adventive is twenty-eight percent and ranges from zero to seventy-seven percent. Twenty-five of the wetland sites have a Percent Adventive below 25 percent and seventeen sites have a Percent Adventive between 25-50 percent. Approximately, on average, a quarter of the species observed in wetlands are adventive (non-native). The most abundant of these non-native species are reed canary grass, curly dock, yellow foxtail, barnyard grass, bull thistle, water pepper, and giant chickweed.

The size of a wetland correlates with the kinds of functions and the intensity that these functions operate. Ninety-three wetlands in the project area were less than 0.2 hectare (0.5 acre) in size. Forty-five wetlands are between 0.2 and 0.41 hectare (0.5 and 1.0 acre), twenty-five are between 0.41 and 0.82 hectare (1.0 to 2.0 acres) in size and forty are greater than 0.82 hectare (2 acres) in size. The size range for wetlands in the project area is from .02 to 2.77 hectares (0.06 acre to 6.84 acres).

Seven wetland communities have been identified in the project corridor. These and the number of sites in parenthesis are as follows: Farmed wetland (2), wet meadow (70), sedge meadow (48), marsh (5), wet shrubland (5), pond (61) and forested wetland (12). Of these seven community types, only five occur proximate to the Alternates (Table 2-21). These five wetland plant communities are further described below.

Floodplain Forest – These forested wetland communities are located on the floodplains of streams or in isolated depressions. The communities are determined by the frequency and duration of flooding and by the permeability of the soil, and the presence of seeps. Typical plant species include box elder, cottonwood, sedges and mannagrass.

Marsh - Includes areas dominated by tall graminoid plants and with water near or above the surface for most of the year. Soils may be peat, muck, or mineral. Dominant plants are cattails, reed canary grass, smartweed, bulrush and sweetflag.

Pond - Ponds are natural or artificial. Non-maintained ponds support wetland vegetation around the periphery of the pond. Typical vegetation includes willows, cattail, reed canary grass, sedges, rice cutgrass, millet and smartweeds. Ponds are classified on the National Wetlands Inventory Maps as either palustrine unconsolidated bottoms or palustrine open water wetlands.